

# PRELIMINARY CROCODILE SURVEY—SRI LANKA<sup>1</sup>

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(With eight plates)

## INTRODUCTION

The investigators were invited by the Sri Lanka Wildlife and Nature Protection Society to undertake a crocodile survey of the Island. Due to political tensions the survey was underway only by the 20th of September 1977. The investigators arrived by ferry at Talaimannar and started on the road by Jawa Motorcycle from there via Anuradhapura via the coast and thence south to Hambantota and Yala north to Uda Walawe, east to Kumune and Pottuvilp, north to Amparai and Batticaloa, north and west to Polonnaruwa and Anuradhapura and north to Mullaitivu, Elephant Pass, Mahawilachhiya, and then south to Colombo on the inland route. Detailed, proforma based data were gathered for 40 representative tanks during the survey which lasted till November 1st. In addition, hundreds of ponds, reservoirs, streams and rivers were examined, local crocodile censuses taken, local residents interviewed and general data pertaining to crocodiles was gathered.

(1) The first part of the following report will give excerpts from writings of early naturalists and explorers which invariably point to the great abundance of both the species of crocodiles of Sri Lanka—the freshwater marsh crocodile or mugger (*Crocodylus palustris*) and the saltwater or estuarine crocodile (*Crocodylus porosus*). These are variably called

hale kimbula and gette kimbula in Sinhalese according to the part of the country. To help regularize vernacular names we might adhere to what seems to be in widest common use is hale kimbula (sluggish) for *C. porosus* and gette kimbula (rough-skinned) for *C. palustris*. In Tamil, *C. palustris* is often known as kulathu (tank) muthalay and *C. porosus* semmukan (copper noscd) muthalay or kadal (sea) muthalay.

(2) The second part will be the Island with relation to its 300,000 acres of estuarine habitats and 100,000 acres of tanks. One outstanding feature is that there are no natural freshwater lakes. The over 10,000 man made tanks were constructed between the 5th century BC and 14th century AD, providing greatly expanded habitats for *C. palustris*. *C. porosus* probably benefitted by the mugger's possible shift from the rivers and lagoons.

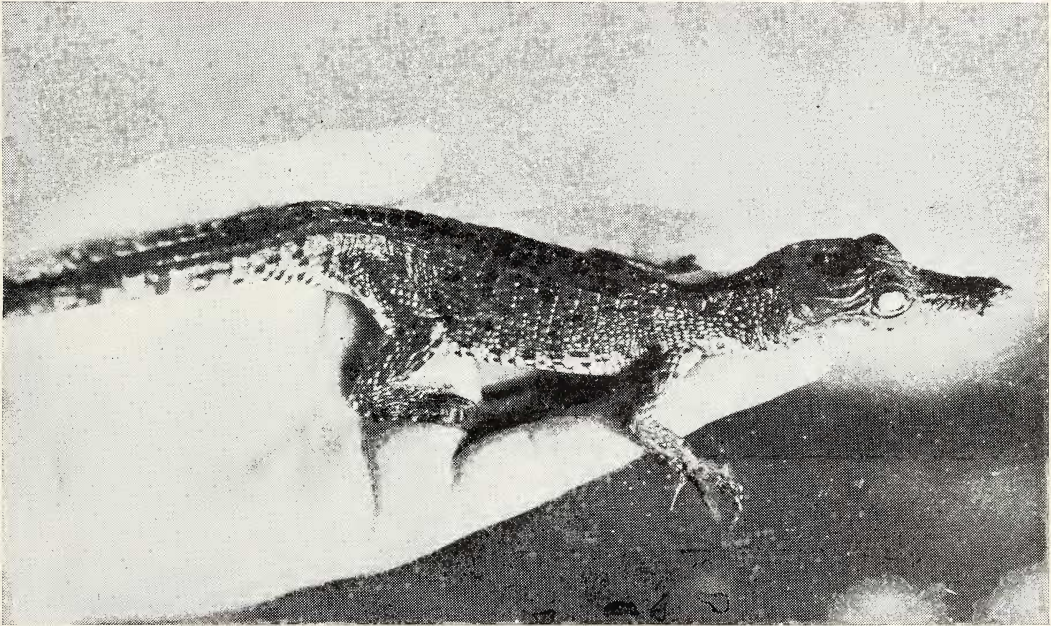
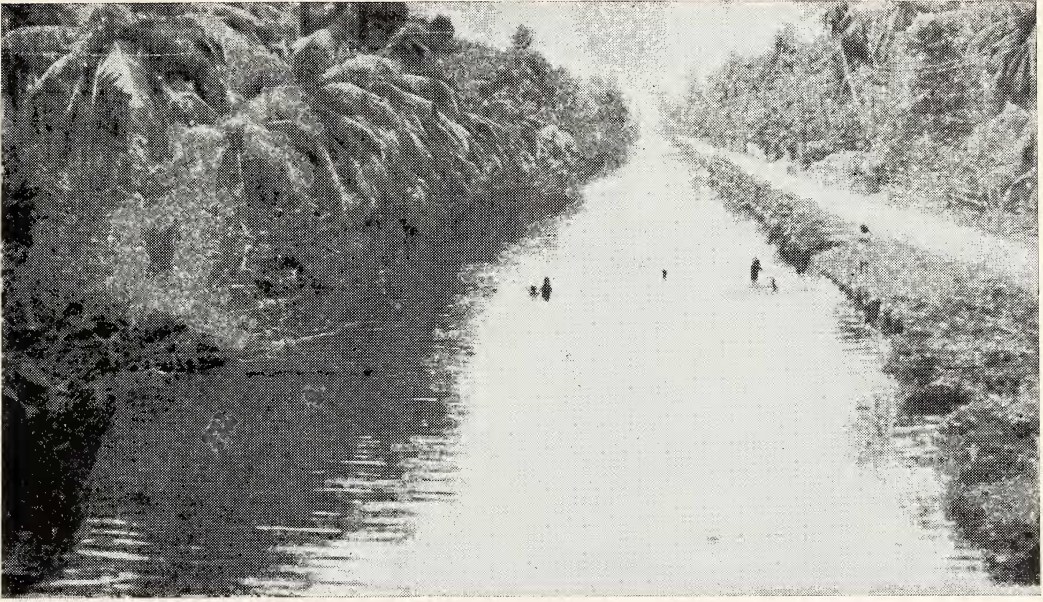
(3) The third part of the report traces the recent history of the crocodile in Sri Lanka, starting from the 1930's.

(4) Part Four describes the findings of our recent 40 day trip (Sept.-Nov., 1977) through the Island's main crocodile habitats, including data from a fortnight's visit in August 1976. The appendix includes a list of places actually visited by the investigators during the survey with a brief summary of findings at each location of previous or present crocodilian importance.

(5) Part Five is the conclusion and outlines the value of crocodiles in the wild and suggests conservation measures.

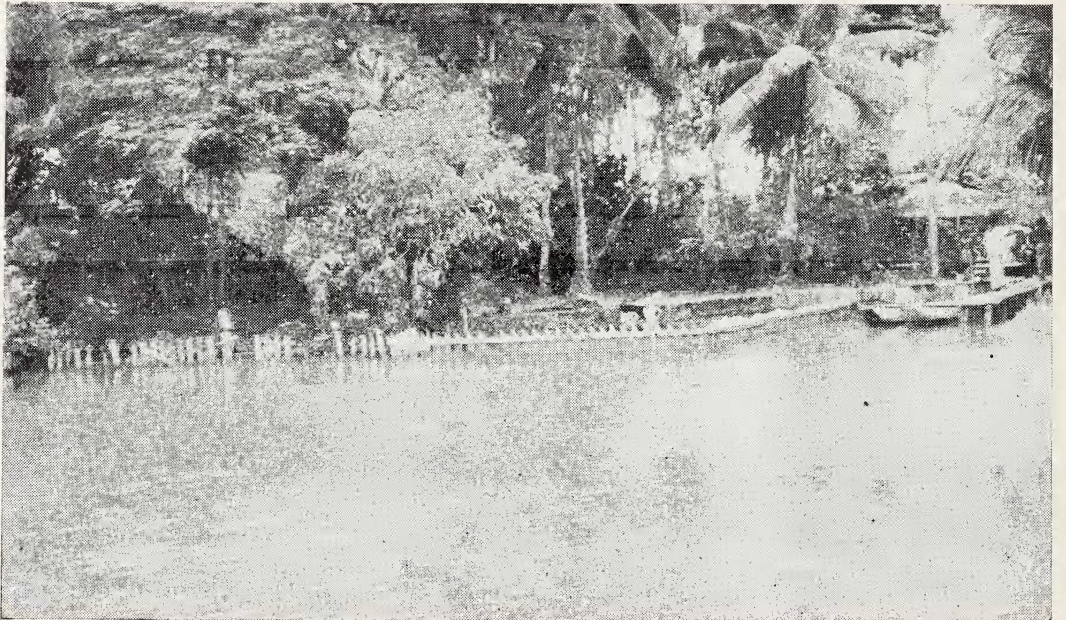
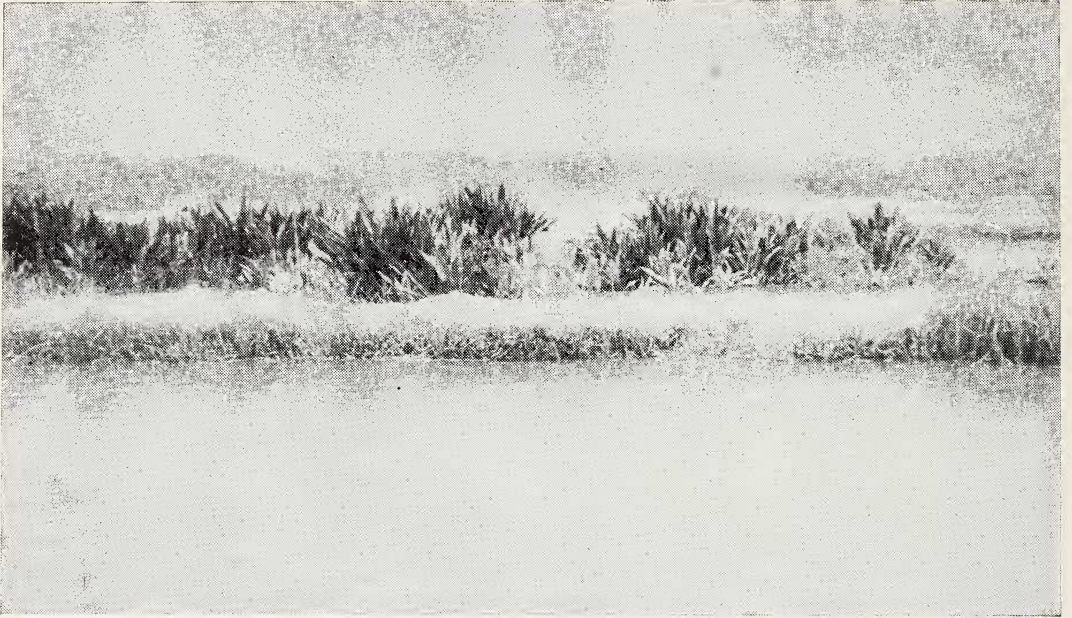
<sup>1</sup> Accepted May 1978.

<sup>2</sup> Madras Snake Park Trust, Madras-600 022.



*Above:* Canal near Negombo draining Muthurajuvela swamp.

*Below:* *Crocodilus porosus* hatchling found near Colombo.



*Above: Lagenandra, along the Nilwala Ganga; remnants of once dense C. porosus habitat. Below: Crocodile proof bathing fence on the Nilwala Ganga.*

METHODS AND EQUIPMENT

Low budget survey techniques deserve a more important place in the field of conservation. The need for continual monitoring of populations of critically endangered and exploited species and the importance of the initial investigations into census and status are obvious. Conservation organizations could continue to encourage "semi-formal" surveys toward the eventual goal of having an up to date/accurate picture of the status of species threatened by habitat loss or poaching. Wildlife Departments could open a Survey Wing with interested field staff and cooperation with the University and all the numerous government agencies which already have the means to collect data on most forms of wildlife in need of surveys and possibly protection/rehabilitation. Discussion with local residents is most rewarding but one must gain experience in judging levels of exaggeration and confirm crocodile size and population estimates by personal observation. It is a universal tendency to over estimate size and numbers of crocodiles seen.

EARLY WRITINGS ON CROCODILES

1. "Few reptiles are more disgusting than these brutes; but, nevertheless, their utility counterbalances their bad qualities, as they cleanse the water from all impurities. So numerous are they, that their heads may be seen in fives and tens together, floating at the top of the water like rough corks..." Baker, 1855.

2. "Among these (creeping things) the Crocodile comes before all other, since it is very great both in number and size..." Heydt, 1744.

3. Chit Aru (near Giants Tank) "abounds in alligators." Ward, 1859.

4. Insurumuniya Temple—"Before and behind lie large lotus ponds on whose banks huge crocodiles may be seen...the monks now resident have placed it at the disposal of the crocodiles whom they encourage by providing them with food." Cave, 1900.

5. "This is the one (*C. palustris*) so common in the tanks of the Jaffna peninsula." Ferguson, 1877.

6. "All the (low country) tanks, rivers and forest pools swarm with them (crocodiles)." Clark, 1901.

7. "Among the amphibious creatures, the Kaiman, or crocodile, call'd Lagarto by the Portugueses, is very frequent here; some of which are eighteen feet long. They have four feet with crooked claws, their skin covered with scales, which are so hard on the back, that they are musket proof...In Jafnapatnam there are many crocodiles in the fens, ponds and lakes; which if they happen to dry up in the summer, they dig holes to live in..." Baldaeus, 1671.

8. "...to the present day the Europeans apply the term alligator to what are in reality crocodiles, which literally swarm in the still waters and tanks throughout the northern provinces but rarely frequent rapid streams and have never been found in the marshy elevations among the hills."

"The lagoon of Batticaloa, and indeed all the still waters of this district are remarkable for the numbers and prodigious size of the crocodiles which infest them."

Mullaitivu: "The fort is surrounded by the remains of a military ditch of considerable depth, and, as usual, filled with crocodiles... Another inlet of the sea which we crossed on leaving Mullaitivu was also swarming with these creatures." (Tennent, 1859).

9. "The alligator of Ceylon is never seen in rivers amongst the mountains or hills: it is

confined to the low country, and abounds most in the lakes and tanks in the northern and southern parts of the island." Davy, 1821.

10. "In all probability it was this reptile (estuarine crocodile) which was so petted by the Portuguese soldiery at Malwara, Colombo, Kalutara and other river forts; and Kayman's gate in Colombo perpetuates the memory of their former abundance." Deraniyagala 1930.

11. "On any bit of bank or rock projecting out of the water you are certain to see numbers of loathsome crocodiles basking open-mouthed in the sun..." (in the N.C. Province) Storey, 1907.

12. Nanthi Kadal..." where we saw so many crocodiles and innumerable birds above them..." Falck, 1767.

#### THE ISLAND: FRESHWATER AND ESTUARINE HABITAT

Sri Lanka lies between the 5th and 10th parallels and except for the high hills has a year round tropical climate. The island is 25,332 sq. miles in area and composed of three well marked plains of erosion termed "peneplains." Each peneplain has developed a characteristic fauna whose distribution is affected by temperature and rainfall. The dry zone comprises most of the coastal and low country area, it receives less than 75 in. of annual rainfall. The wet zone is mainly on the south west coast and the 2nd and 3rd peneplain and receives over 75 in. of rain.

Sri Lanka has 34 major river drainages. 7 are in the dry zone, 2 in the dry and wet zones, 25 in the wet zone. The major wet zone rivers are perennial, the dry zone rivers shrink in the dry season and may dry in drought.

There are no natural freshwater lakes in Sri Lanka. Rivers and streams were dammed

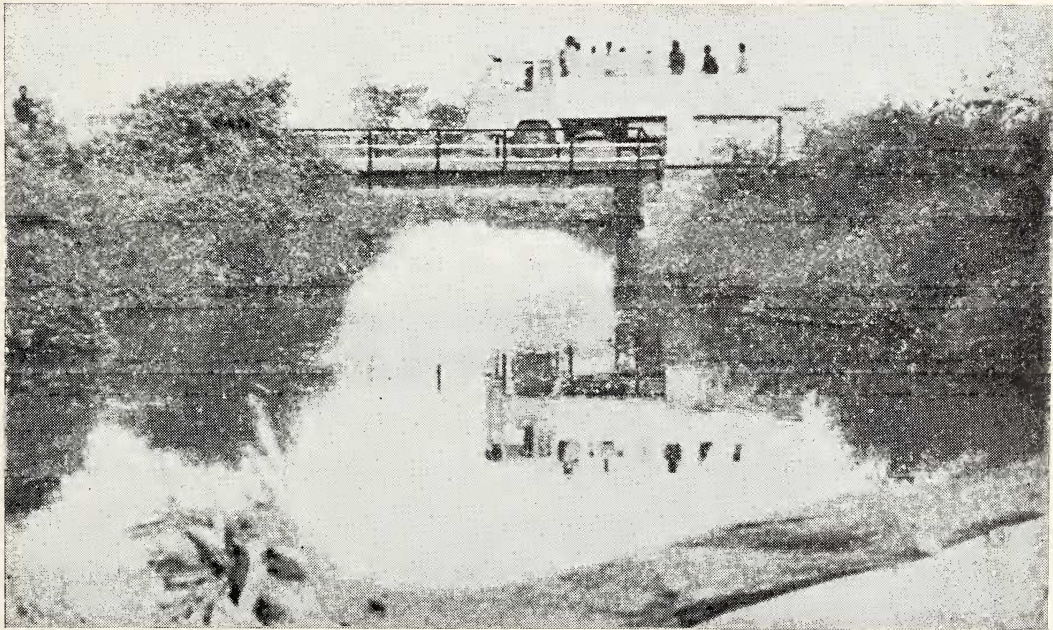
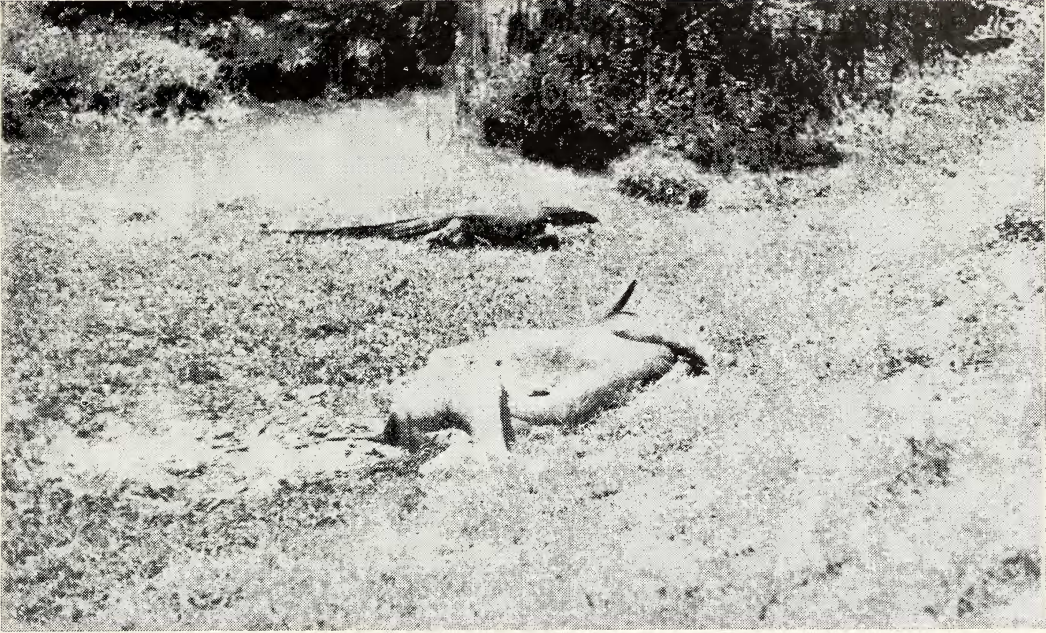
from about the 5th century B.C. and major tank construction continued till about the 13th century AD. Most of the 1st peneplain dry zone was colonized then and in the 11 million acres of this area over 10,000 tanks were constructed with a complex network of channels.

The human population in those days is estimated at 10 million. Invasion and drastic population decline shortly thereafter caused much of what was once farmland to revert to forest. The tanks which became jungle tanks, (some of which lie within the present National Parks), became the main crocodile habitat.

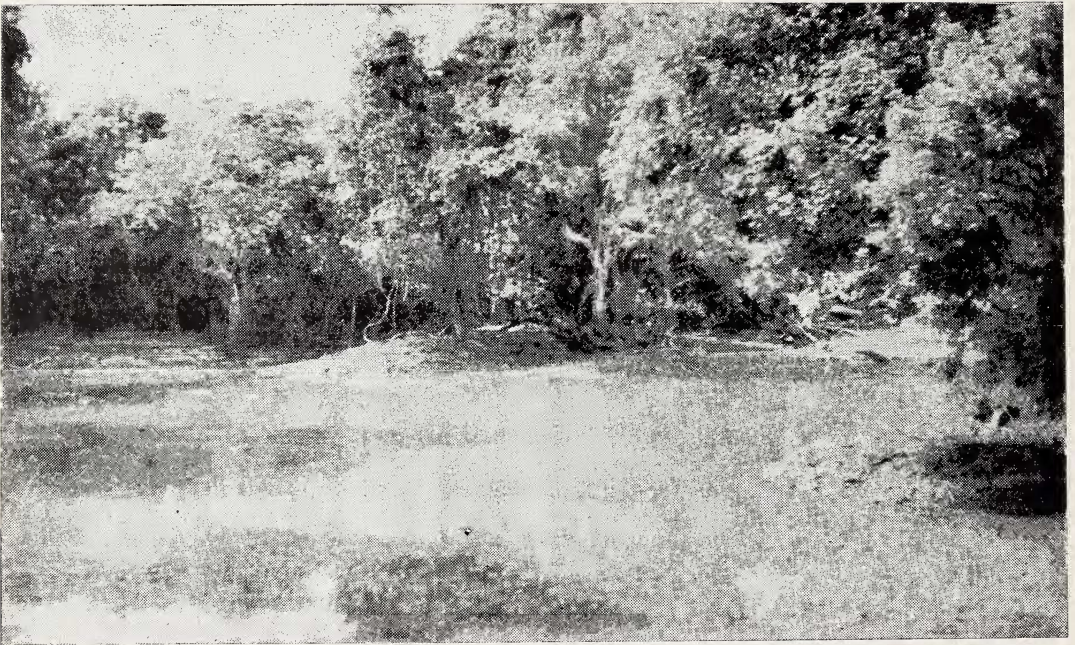
The term "tank" is conveniently applied to any man made body of freshwater whether it is a village tank of an acre or the Senanayake Samudra Reservoir which is 19,000 acres. Since these form the main *C. palustris* habitats of Sri Lanka it would be appropriate that a study of the crocodile's role in tank biology be undertaken.

Mugger are also found in many of the main rivers notably the Mahaweli Ganga and the Yala stretch of the Menik Ganga. There is little reference to march crocodiles in rivers in the old literature and in interviews and we found that though scattered, small populations exist, concentrations of mugger only occur in tanks. Crocodiles have rarely penetrated to the 2nd peneplain. Deraniyagala and others report crocodiles in low-land lagoons, salt pans, river deltas, canals and swamps, and in isolated instances on the 2nd peneplain. This year a crocodile was observed for the first time at Gampola near Kandy, an elevation of about 450 m. It was possibly an escapee from captivity (da Silva 1977).

There are numerous references in literature of crocodiles in the salt pans of the southeast and the salty wilas of Wilpattu. These are mugger and seem to be able to tolerate concentrations of salt higher than sea water for long



*Above:* The water monitor, important predator on crocodile eggs, is common in south-west Sri Lanka. *Below:* Small tidal affected stream in southern Sri Lanka. Habitat of *C. palustris*.



*Above:* Palatupana Lagoon near Yala. Saline habitat of *C. palustris*. *Below:* The Wila Oya stream as it flows into Panama Tank. Largest concentration of *C. palustris* was observed here.

periods. During the dry season when the shallow salt lakes (occasionally connected to the sea via a small lagoon) shrink, the salt concentration causes a massive fish kill on which crocodiles, birds and other scavengers feast (Spittel 1924). Near Palatupana we found a group of 2 week old hatchling mugger in lagoon water of 3.38% salinity. It had been thought that up to a certain age juvenile crocodiles cannot tolerate such a concentration. The edge of the lagoon was strewn with dead and dying mullet (*Mugil* sp.)

Other occasional *C. palustris* habitats include unlikely places like deep pools in small streams, old wells and urban and suburban weed-choked canals. Although big, breeding size mugger are generally too conspicuous to survive for long near human habitation, smaller individuals often do very well if they learn how to stay out of sight. Deraniyagala mentions that *C. palustris* favours the sycamore (*Terminalia arjuna*). Tree root systems overhanging river and pool embankments provide perfect tunneling habitat.

The estuarine crocodile (*C. porosus*) is a completely different animal and prefers a different habitat. Just inland of the sea on the western coast beginning at about Puttalam and going south, is a stretch of intermittent swampland. Much of this been cleared, drained and converted to paddy land and even filled in; but considerable areas remain. The best areas are centred around the main rivers draining into the sea on the southwest and southern coasts. The Maha Oya, Kelani Ganga, Bentota Ganga, Gin Ganga and the Nilwala Ganga were once famous for crocodiles.

The remaining swampland, comprised of mangrove, cane, flag grass, pandanus and other thick semi-aquatic vegetation, is an ideal home for *C. porosus* and indeed, Sri Lanka's

main remaining breeding population appears to exist on this coastal strip. The lagoons of Pottuvilp, Batticaloa, Trincomalee and Mullaitivu may once have harboured considerable *C. porosus* populations (see old refs.), but no more. One well known estuarine crocodile reported to be 5-6 mts in length is seen regularly between Panama and Kumune on the south east coast and apparently a few are left in some of the denser mangrove thickets north of Trinco. This is a more or less solitary animal as compared to the gregarious mugger. The female requires a very secluded, undisturbed area to build her metre high, conspicuous nest and the available habitat is considerably diminished. The proposed Free Trade Zone between Negombo and Colombo will cause further inroads as the Muthurajavela swamp is cleared and drained. This animal needs a sanctuary if it is to survive in Sri Lanka. *C. porosus* has not been reported far inland in Sri Lanka. It apparently will not dwell in the same area as *C. palustris* and, as elsewhere in its range, it probably keeps its own preferred area clean of mugger. Deraniyagala writes that *C. porosus* is associated with mangrove and flag grass (*Lagenandra*).

There is still much to be discovered as to the distribution of Sri Lanka's two crocodiles. Their habitat preferences tend to generally separate them but there are obvious overlaps. Mugger are generally easily observable as they tend to live and bask in open areas; the estuarine crocodile is generally more shy, and more apt to stay hidden. Even night survey techniques may be far from accurate in areas where heavily hunted crocodiles become "light shy" and remain only in the least accessible coastal and river delta mangroves.

The natural habitat of crocodiles in Sri Lanka has been further altered by thousands of miles of man made canals and channels of



many proportions and functions. In some cases these modifications are beneficial to crocodiles, offering alternate habitat, hunting habitat and access to other tanks.

#### RECENT HISTORY OF SRI LANKA'S CROCODILES

"No longer do crocodiles bask in the sun in the tanks of Ceylon. The avariciousness of man has all but exterminated them. Although these antediluvian monsters are not beautiful to look upon, yet they are part of nature's scheme and did give a certain charm to the tanks. Man set up a factory, seeking quick wealth from the tanning of crocodile skins; and within ten years, he has to close down the factory because there were no crocodiles left to tan" (Hennessy 1949).

"The great demand for crocodile skins tends to thin out considerably the numbers of these reptiles so much so that in recent years it has not been unusual to see in tanks affected by drought hundreds of fishes which would have fallen prey to the voracious creatures lying dead on the dried up bed there to putrefy and cause ill health to the people residing in the adjoining areas." (Somanader 1941).

Deraniyagala writes similar bleak findings. He wrote that crocodile hunters take a heavy toll of mugger in the dry season using large-meshed 'kimbul dale' (crocodile nets) and harpoons and that "the species which was so common in 1925 is now rarely found in any numbers and specimens 3 metres long are very scarce," (Deraniyagala 1939). Regarding record size he mentions 2 of about 5.25 mts. (18½ ft.) shot in 1916 in Kantalai Reservoir. He further states that before hide hunters reduced numbers (during the late 1920's and early 1930's) "troops of over 100" *C. palustris* could be commonly seen basking on bunds of reservoirs. He maintains that this

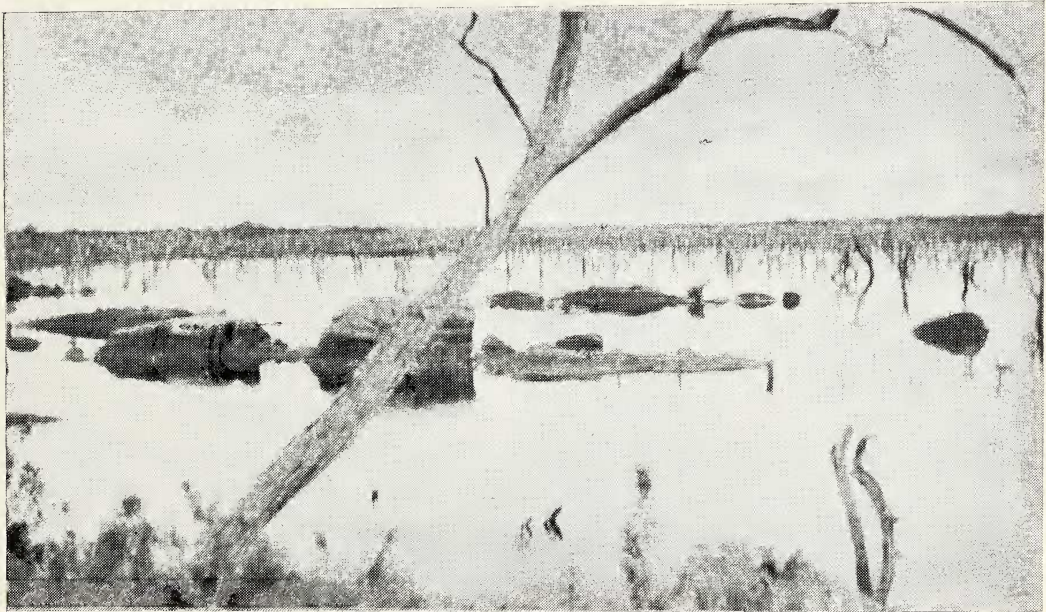
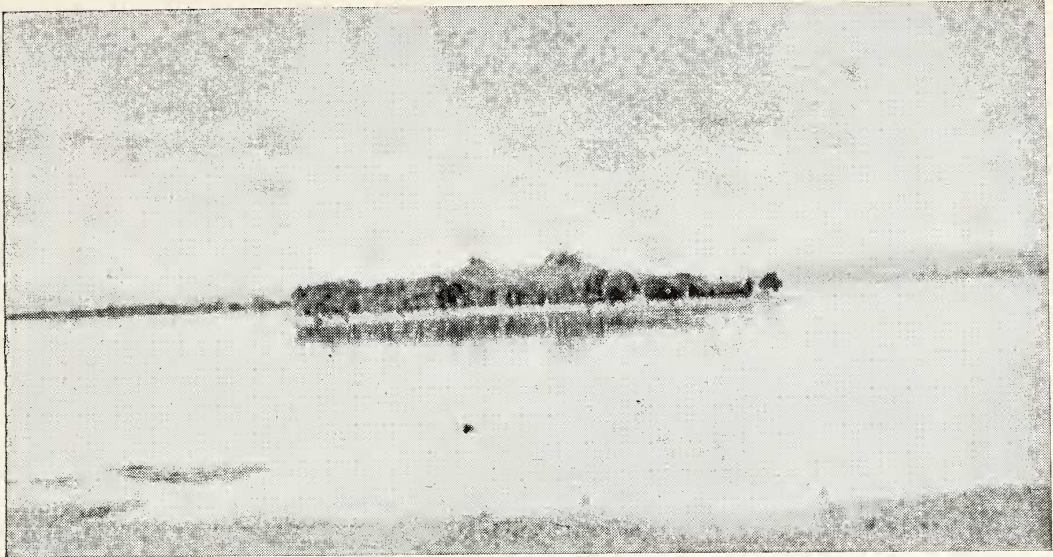
species has become scarce along the coast with the spread of firearms.

Regarding *C. porosus*, little has been written of its previous abundance but judging from the excellent habitat which was available for the species it must have been plentiful on much of the coast.

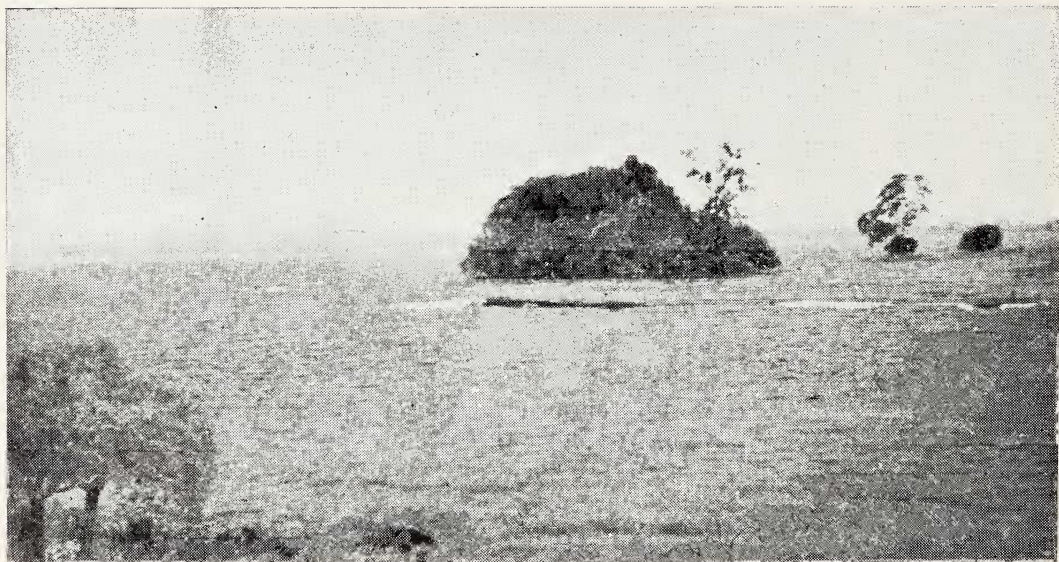
We searched through records in the Chamber of Commerce, Colombo, but apparently crocodile skins were included in the general "hides" category for there are no statistics. It is unknown how many skins were contributed to the world trade (which has fluctuated from 2,000,000 to perhaps 10,000,000 skins per year) but the fact remains that crocodiles were considerably depleted by the late 1930's.

In 1946 crocodiles were placed on Schedule IV of the Fauna and Flora Protection Ordinance which means they cannot be shot without a Special License, allowing one crocodile to be taken. The export of crocodile skins is totally banned. Combined with adequate habitat protection it would seem that these laws, if enforced, would ensure the future of Sri Lanka's crocodiles. The two factors running against that supposition are the sale of dry crocodile meat (without the risk of dealing in the skins) and the chance of smuggling of skins to India. In late 1975 the Indian Excise authorities seized 86 crocodile skins at Dindigul with markings on the crate indicating that it had come from Sri Lanka via the ferry to Rameswaram. We examined the skins during the auction in Madras and they were apparently of the Sri Lanka race of *C. palustris*. Since crocodile protection is now being enforced in India the rarity of skins has put the price up considerably and sources from neighbouring countries like Sri Lanka are obviously being examined by the illicit dealers.

In 1976 four crocodiles were caught in the Mahaweli Ganga in a trapping operation or-



*Above:* Large tanks of North and North central Sri Lanka used to contain large numbers of *C. palustris*. *Below:* Stumps of thousands of trees protrude from many of the tanks reclaimed from the jungle in the past 50 years such as here at Mahakandarawa Wewa.



*Above:* The larger, perennial tanks, such as Iranamadu (North Sri Lanka) contain fewer crocodiles than the drought affected smaller tanks of south eastern Sri Lanka.  
*Below:* Crocodiles migrate to permanent water as the annual tanks turn into swampy grassland in the dry season.

ganized by a local MP (Loris, June 1976). We heard several other similar reports of crocodiles killed by police after allegedly attacking humans. Large crocodiles occasionally do attack humans just as may (in India) the rare man-eating tiger. Crocodile attacks will not happen when basic precautions are taken. People have lived in close proximity to good crocodile habitat well stocked with crocodiles for centuries. In some places, such as the Nilwala Ganga, when an occasional oversized crocodile became a "nuisance crocodile" and attacked humans or dogs, it was generally caught or killed. In some bathing areas along the river wooden fences are built to keep out water weeds and inquisitive crocodiles. In Vol. XII No. 3 (1971) of Loris the Editor remarks "Crocodiles are threatened with extinction all over the world. In Ceylon this is true of at least the Estuarine Crocodile (*C. porosus*)."

#### CROCODILE SURVEY RESULTS

In August, 1976 the authors spent a fortnight in the southern part of Sri Lanka visiting crocodile habitats with a herpetologist colleague in Ruhunu National Park and adjacent areas and resolved to return for a more intensive survey in 1977. We approached the Wildlife and Nature Protection Society of Ceylon for funds to support the survey and the Committee approved our grant request for Rs. 3,500. Together with the Rs. 3,500 sponsored by the Madras Snake Park Trust for the survey, we were able to spend 40 days in Sri Lanka, our assistant and ourselves covering about 4000 Kms. by motor cycle, 1000 Kms. by jeep and car plus boat travel and foot work. We visited representative tanks, reservoirs, rivers, lagoons, and backwaters in every district in which crocodiles occur and made a detailed coverage of 40 tanks plus several lagoons. Due to transport and weather

limitations we were unable to make adequate coverages of the two large national parks and the wilderness area south and east of Wasgomuwa. These brief periods spent in the crocodile habitat in Sri Lanka provided an excellent general picture of the current status and direction of the two species. The mugger still survives in small numbers in almost every District with concentrations as of the "old days" in the two main National Parks. The skin industry already written about brought the populations down and the current meat industry is holding them down. The estuarine crocodile succumbed to the same pressure but shows less recuperative powers and has lost much of its habitat. The trip diary and summarized results appear in the appendix following the Conclusion.

#### CONCLUSION

There is no doubt that crocodiles are an essential ingredient in the healthy ecology of tanks, reservoirs, rivers and lagoons in a tropical country like Sri Lanka. For reasons both religious and cultural and due to the efforts of the W.L. Dept. the two species of crocodiles of this island have retained a better foothold than throughout the rest of their territory.

The Alligator is being protected in America for its value in the swamp ecosystem. The habit of the Nile Crocodile of feeding on predatory fish is earning its rehabilitation in Africa. In India massive FAO/UNDP technically aided projects are underway to save the gharial (*Gavialis gangeticus*) from extinction and help recuperate the two species of crocodiles as valuable renewable resources. In Papua—New Guinea similar UNDP projects have been underway for several years.

Many tanks in Sri Lanka have some forest cover. This is of importance not only in the vital role of preventing erosion and siltation

but also in providing wildlife habitat. The annual tanks of the south-east and north-west parts of the Island are now the most dynamic crocodile habitats. The annual drying up of these tanks provides the crocodiles with several months of easy food availability. These parts of the country are among the least densely populated and include the two National Parks, Ruhunu (240 sq. miles) and Wilpattu (280 sq. miles). These are not only Sri Lanka's most dynamic populations, they are also most vulnerable, to drought.

The mugger would be fairly easy to rehabilitate in many parts of the country where the tanks are remote from disturbance or where local residents would not discourage a healthy population (as is still the case at present in several areas like Panama Tank and in the Mullaitivu area). Crocodile killers are usually groups of itinerant fishermen. Since the tanks are generally under the Irrigation Board there are rarely any Wildlife Department staff nearby and no routine checks made.

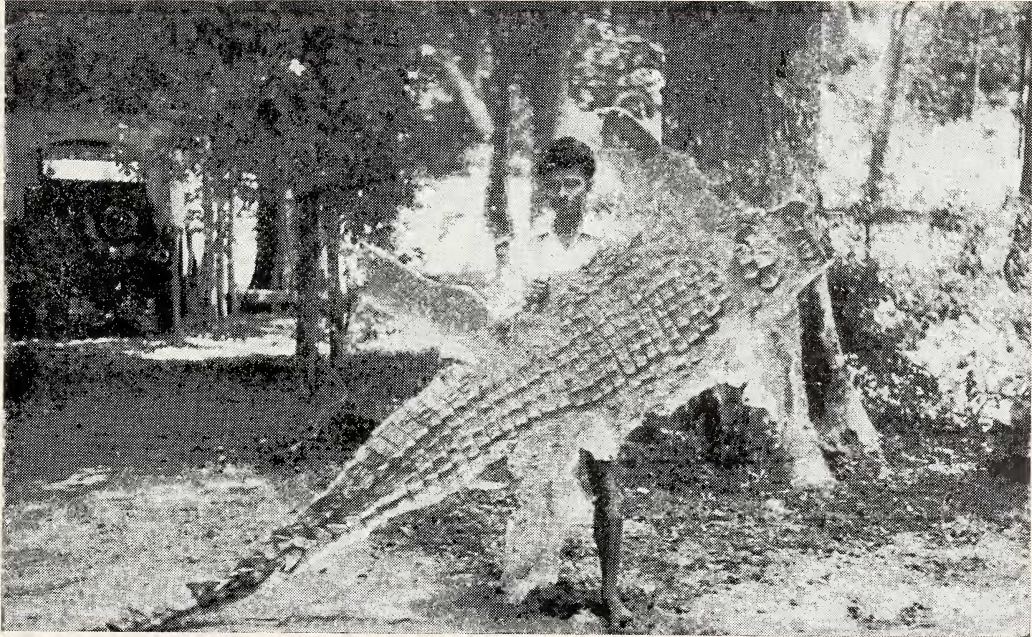
The estuarine crocodile is a more difficult animal to provide suitable undisturbed habitat for and most coastal habitat is becoming well settled. It would be timely for one or more *C. porosus* habitats to be examined for suitability as preserves for this dwindling species.

In the case of both species several important measures could help conserve them: (1) Further, detailed survey work to map out exact distribution and status; monitoring and periodic census checks are especially important in populations of reptiles like *C. palustris*. Their vulnerability in drought, their cross country migratory habits due to drought or disturbance, and the variable success of fishermen in seasonal crocodile killing makes the *C. palustris* population of Sri Lanka a rapidly changing picture. (2) Indexing of available habitat for suitability as crocodile preserves. (3) Strict en-

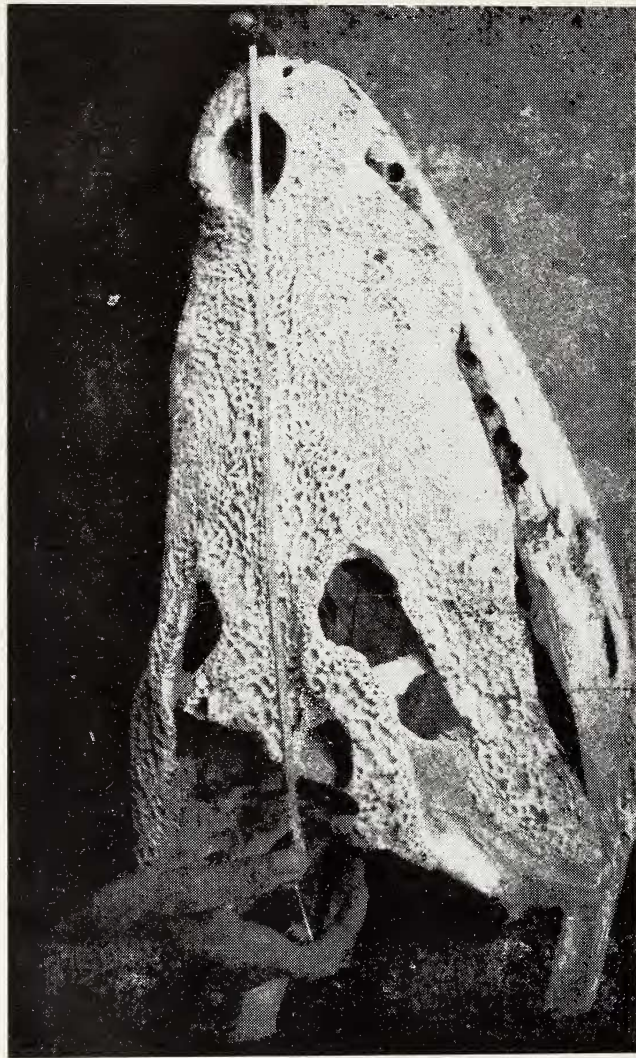
forcement of existing laws protecting crocodiles by increasing field wildlife protection staff, publicity and cooperation of police, customs etc.

The Colombo Zoo could set up an effective "rehabilitation and rearing centre" for the "orphan" and nuisance crocodiles that continue to be brought in as habitat inroads progress. When suitable crocodile preserves have been identified and protection guaranteed, stock being reared in this crocodile "bank" could be used for restocking these wild habitats. A squad of expert crocodile handlers could be trained to deal with crocodiles guilty of attacks on live stock or humans which should be caught and transferred. Officers of the Wildlife Service in Florida, U.S.A. receive this sort of training.

The association of on going studies of crocodile habits would help wildlife staff solve complex problems such as homing behaviour, migration, territory, population densities, survival in drought conditions, and the role of crocodiles in the tank and estuarine ecosystems. The concept that the ecological roles of all wildlife are relevant to our environment is gaining in favour, it remains to document the crocodile's specific value and place in Sri Lanka's aquatic and brackish habitats. The past decade has seen a great upsurge in the interest and growth of Inland Fisheries. Many large scale fisheries have come to grief in other parts of the world when the crocodiles were wiped out (India included). Crocodiles were accused by fishermen as being competitors for fish and wrecking nets when accidentally entangled. Actually, crocodiles may feed more on the sedentary species of predatory fish such as cat fish (*Bagarius*, *Wallago*) than the fast and active edible carps (Cott 1961). Crocodiles control numbers of other fish predators including otters, water birds, snakes, turtles, and carnivorous water beetles. The scavenging role of



*Above:* It has been many years since crocodiles have been seen in and around the Jaffna Lagoon. *Below:* A *C. palustris* accidentally run over by a bus near Senanayake Samudra.



The largest *C. palustris* skull we measured in Sri Lanka. Nostip to occiput: 51.5 cm;  
lower jaw 66 cm; the crocodile was said to be 13½ feet long.

crocodiles is well documented and appreciated but there are many more subtle yet important ways in which crocodiles fulfill an important function in nature. A scientist studying caiman on the Amazon determined the nutrient role of these relatives of the alligator and their importance to the fish productivity of the waterways (Fittkau 1970, 1973).

In several cases good crocodile habitat lies within sanctuaries already formed by the Government. Unfortunately there is little field protection afforded to these areas (aside from the major National Parks). Besides further survey and study the serious job of crocodile protection must be strengthened by creating positive public opinion. Crocodiles do not have the good looks and appeal of the elephant or tiger on their side but their presence on this earth for the past 200 million years, their ecological, touristic and their potential economic value as a resource can be conveyed to the public through mass media, the zoo and special publications.

The main current cause for crocodile decline in Sri Lanka is the depredation by fishermen for the meat which is dried and sold locally or sent to the larger fish markets and sold as crocodile (where in demand for purported "medicinal" value) or as dry shark (which it closely resembles). Several Karawa fishermen interviewed at somewhat remote tanks like Mahawilachchiya openly discussed their crocodile business. Even without the skins it is profitable for them; dried *Tilapia* and other fish sell for about Rs. 3/- per lb. whereas crocodile brings Rs. 4-5 per lb. It is a fairly simple and easy to conceal side business for the fishermen who have the equipment (nets) and who make regular rounds of even the most remote tanks during the dry season when fishing (and crocodile catching) is easiest. The fishing permits are issued by the Executive Engineer, Irrigation and neither the Fisheries nor Wildlife Department are informed of these activities.

These people plus a few isolated wealthy "sport" and skin hunters are the main direct sources of human pressure on crocodiles. Other killers of crocodiles are a number of specialized hunters who have learned the poachers' artful methods such as baited hooks (favourite baits being pups or monkey meat), night harpooning, noose trapping, removal from burrows and simple netting. One such hunter is old "Muthalay Peter" of Batticaloa. He was active back in the days of legalized skin dealing and at one time had 20 hunters working for him. Now he only kills the occasional crocodile which the Government Agent deems a nuisance crocodile in an inhabited area. Other important negative influences are the continued clearance of forest cover around tanks (which is so devastating to the land and all wildlife), and other large scale projects of "development".

Having identified the factors responsible for the decline of crocodiles and having acknowledged their value and usefulness it remains for these reptiles to be publicized and protected. Sri Lanka has much natural wealth to be proud of, not the least of which are its impressive crocodiles.

Based on observations, interviews and estimated carrying capacity of the areas surveyed the following estimates do not include first year hatchlings, numbers of which show great fluctuations due to high mortality

	Total	Breeding Females
<i>C. palustris</i>		
Ruhunu National Park (and periphery)	1000	100
Wilpattu National Park	800	75
North and North-Central	500	50
Rest of Country	500	50
Total	2800	275
<i>C. porosus</i>		
South-west coast	250	25
Rest of country	125	15
Total	375	40



SUMMARY OF SURVEY RESULTS (SRI LANKA)

No. Date	Name of Tank, River, Lagoon etc.	District	Size	River Basin	Approximate crocodile population	<i>C. palustris</i> seen	Remarks.
1. 23-9-77	Giant's Tank	Mannar	5050 acres	Aruvi Aru	20-40	—	Fishermen & cowherders say crocodiles only on southern shore during these dry months and scatter to forest when tank completely dries. Good habitat within a sanctuary.
2. 23-9-77	Aruvi Aru (Madhu Road)	Mannar	10m. wide	Aruvi Aru	nil	—	Though reported to be common in the old literature, crocodiles are rarely heard about in this area now.
3. 24-9-77	Puttalam Lagoon	Pattalam	35km. long	—	nil	—	Crocodiles are no longer found here according to fishermen. Fishermen of these areas included crocodiles in their catches and dried the meat for sale.
4. 24-9-77	Mundal Lake	Pattalam	10km. long	—	nil	—	Crocodiles (probably <i>C. porosus</i> ) seen in recent years in some of the inland swampy areas.
5. 1-10-77	Menik Ganga	Monaragala	20m. width 2m. depth	—	0-2/km. in wild areas	2 adults	This river rarely dries up and has perennially deep pools which are extremely important crocodile refuges in drought years. There are numerous tunnels under tree roots in the banks adjacent to these pools. In 1974 we saw 16 adult crocodiles living in one of these pools near Kataragama. The two adults seen this trip were 100m from the main bathing ghat.
6. 1-10-77	Yoda Wewa	Hambantota	128 acres	Kirindi Oya	25-50	—	Western shore has some jungle — Rarely dries up completely.
7. 1-10-77	Debra Wewa	Hambantota	100 acres	Kirindi Oya	50+	3 adults	The perennial deep water is on the east bund where the crocodiles remain.
8. 1-10-77	Tissamaharama	Hambantota	706 acres	Kirindi Oya	50+	—	Perennial tank, famous for bathing. Baby crocodiles seen annually on small island eastern shore.

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9. 1-10-77	Wira Wila	Hambantota	Kirindi Oya 25-50	18 most adults	Bordered by jungle on the west. Both this and the preceding tank lie within the 16 semi-Wirawila/Tissa Sanctuary (declared in 1938).
10. 2-10-77	Palatupana Lagoon	Hambantota 300m. x 100m.	—	1 adult, 10 hatching	Just a few metres from the sea; water as salty as seawater. Crocodile tunnel and 2 week old young seen. On the border of Yala National Park.
11. 2-10-77	Palatupana Tank	Hambantota 500m x 200m.	—	35 50% adult	Though outside Yala Park receives full protection. Domestic buffalo and crocodiles share same mud flats.
12. 2-10-77	Hing Wewa	Hambantota 300x200m.	Menik Ganga	16 mainly adults	Within Yala, Hing is one of the last tanks to dry up. Ideal place for crocodile study in minimally modified habitat.
13. 2-10-77	Vikapalava Wewa	Hambantota large, shallow	Menik Ganga	27 mainly adults	Many water birds, within Yala.
14. 2-10-77	Menik Ganga at Yala	Hambantota 60m. wide 1-2m. deep	Menik Ganga	1 adult	This river is the main drought habitat in the whole western part of the Park.
15. 2-10-77	Rakinavala waterhole	Hambantota 100m diameter	—	1 subadult	This is one of the many water holes in Yala which contain 1 or 2 transient crocodiles.
16. 2-10-77	Palug Wala Wewa	Hambantota 50x50m.	—	3 adult	Small tank with transient crocodile population.
17. 2-10-77	Gonalubbe Lagoon	Hambantota large	—	1 adult	Very close to the sea.
18. 1-10-77	Maynet Wewa	Hambantota 250x30m	Menik Ganga	2 adult	Crocodiles move from tank to tank in dry season finishing off the dying fish.
19. 2-10-77	Buttawa Wewa	„ 100x70m.	Menik Ganga	11, mainly adult	Very shallow tank, good fish population within Yala.
20. 2-10-77	Karangaswala, waterhole	„ 50x30m.	—	1 adult 3 hatching	This waterhole is apparently occupied by no other crocodiles.
21. 2-10-77	Urniya Wewa	„ 50x30m.	—	4	2 adults, 2 subadults in this Yala pond.
22. 3-10-77	Godekalapuwa Lagoon	„ large	—	—	Located outside Yala fishermen regularly disturbed this lagoon.
23. 4-10-77	Palatupana Kalapuwa (Lagoon)	„ medium	—	3	Salt concentrations become high enough to kill fish but crocodiles thrive here unaffected.

24.	4-10-77	Hungama Estuary	"	small channels	Ranna River	unknown	—	Swamps of reeds and mangrove interspaced with paddy fields, good <i>C. porosus</i> area.
25.	4-10-77	Tangalle Swamp	"	extensive area	Ranna River	few	—	Cane stands and reed beds with small channels. Crocodiles seen by fishermen.
26.	4-10-77	Mawella Kalapuwa	"	medium	—	nil	—	Reed beds with small channels possible <i>C. porosus</i> area.
27.	4-10-77	Hamunagama Wewa	Matara	"	—	nil	—	Fishermen report that crocodile population killed here 1974-75.
28.	4-10-77	Polatumothere Ganga (near Weligama)	"	swamp channels	—	few <i>C. porosus</i>	—	Typical of the pockets of brackish <i>C. porosus</i> habitat left on the south west coast.
29.	4-10-77	Gin Ganga (near Gintota)	Galle	40m. wide	Gin Ganga	occasional <i>C. porosus</i>	—	Intricate network of channels and swampy areas. Old reports of nests. Permanent military establishment here now.
30.	5-10-77	Nilwala Ganga	Matara	30-50m. wide 2-5m. deep	Nilwala Ganga	formerly many, now few <i>C. porosus</i>	—	Small islands of excellent swampy habitat, inland surrounded by rice paddy.
31.	5-10-77	Bundala Estuary (Sanctuary)	Hambantota	large area	—	both <i>C. palustris</i> & <i>C. porosus</i> seen at high water	—	Mangrove, cane, palm, and hollie swamps interspaced with habitation and cultivation. Up-river pandanus and flag grass. Crocodiles move out of salt pans as they dry.
32.	5-10-77	Chandrika Wewa	Ratnapura	1100 acres	Walawe Gang <sup>1</sup>	10-20	—	Not known for large crocodile population.
33.	5-10-77	Walawe Ganga	Ratnapura & Monaragala	10-20m. wide	"	few	—	Dries up in summer; a few crocodiles in tunnels.
34.	6-10-77	Uda Walawe Reservoir (National Park)	"	8435 acres	"	25-50	—	Very few crocodiles for this large tank. Much disturbance by fishermen at entry of river to reservoir.
35.	6-10-77	Kirindi Oya	Monaragala	10-20m. wide	Kirindi Oya	nil	—	<i>C. palustris</i> does not favour swift water but some permanent pools may contain a few specimens.
36.	6-10-77	Kuda Oya	"	5-10m. wide	"	"	—	Appears to be adequate habitat to support "stream" crocodile population.

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37.	6-10-77	Handapangala Wewa	medium	few	—	Crocodiles reportedly caught by fishermen during dry season with hooks or nets and the meat sold locally.
38.	6-10-77	Buttala Wewa	large	Menik Ganga	—	The upper Menik passes through wild habitat and there is probably a regular movement of crocodiles through this area.
39.	6-10-77	Lahugala Tank (Sanctuary)	574 acres	Heda Oya	20-30 (seasonal) tracks, feces	The lake was dry, the crocodiles apparently having gone overland to nearby pools in tributaries of the Heda Oya.
40.	7-10-77	Panama Tank	308 acres	Wila Oya	100-200 72	This is one of the last tanks to dry up in this area, this seems to be the main reason for the concentration. Cultivation and some fishing is underway but the proximity of the game guards residence and the National Park protects this population, Annual.
41.	8-10-77	Radella Tank	365 acres	Heda Oya	20-30 tracks	Almost dry now, its jungle location makes it very picturesque and excellent seasonal crocodile habitat.
42.	8-10-77	Naula Tank	146 acres	Heda Oya	—	Shallow tank, dry now, crocodiles common when water is there.
43.	9-10-77	Senayanake Samudra	Monaragala 19,250 acres	Gal Oya	25-50	Crocodiles apparently only in Makara area.
44.	10-10-77	Jayanthi Wewa	large	Gal Oya	many	Large reservoir surrounded by rocky hills. Reportedly a large crocodile population but no evidence. Several fishermen report occasional crocodiles sighted. Perennial.
45.	10-10-77	Amparai Kulam	896 acres	Gal Oya	nil	Salivina choked, crocodiles were known some years ago. Elephant come regularly to this tank; retaining its wildness would be most advantageous for Amparai residents. Perennial.

46.	10-10-77	Kondavatkavan Kulam	Amparai	879 acres	Gal Oya	6	—	Up to six crocodiles are seen regularly by residents and fishermen. Fair habitat heavy settlement. Perennial.
47.	10-10-77	Ekgal Aru Tank	Amparai	1015 acres	Gal Oya	25-50	tracks	Crocodiles, including young, are seen regularly by fishermen, rarely caught as they stay among tree stumps when fishermen are active.
48.	10-10-77	Irakkaman Kulam	Amparai	2030 acres	Gal Oya	few	—	Fishermen say very rarely are crocodiles seen as the tank is too shallow, heavily settled.
49.	11-10-77	Batticoloa Lagoon	Batticoloa	50km length	Gal Oya	few	—	<i>C. porosus</i> once very common here. With settlement and mangrove clearance crocodiles killed off and moved out. Still seen on mangrove island in northern part (Kankainadai lagoon).
50.	11-10-77	Rugam Tank	Batticoloa	2550 acres	Mundeni Aru	20-40	tracks, feces	Excellent crocodile habitat surrounded by jungle. Crocodiles concentrated at deep "modu" areas. Hunters from Rugam and Eravur come for crocodiles several times a year it is reported by Irrigation Board Staff. Perennial.
51.	11-10-77	Kitul Wewa	Batticoloa	531 acres	Mundeni Aru	25-50	—	Also surrounded by forest. Small area but good habitat and remote. Crocodiles have tunnels in banks. Annual.
52.	11-10-77	Chenkaladi Aar	Batticoloa	10m, wide	Chenkaladi	few seen regularly	—	Few tunnels in the area, river is perennial. Probably <i>C. palustris</i> , a few holding out in the denser swamps.
53.	12-10-77	Nelum Wewa	Polonnaruwa	10 acres	Mahaweli Ganga	2	—	2 crocodiles seen regularly in this small picturesque tank at the Milk Board. Elephants visit seasonally.
54.	12-10-77	Mahaweli Ganga	"	30-50m. wide 25-30m. deep	Mahaweli Ganga	few seen scattered localities	—	There is plenty of good wild habitat along this river. Crocodiles seen at river junctions (Amban Ganga) and deep river beds; usually one or two. Down river the more remote Sanctuary may have a better population.

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55.	12-10-77	Parakrama Samudra	“	6250 acres	Mahaweli Ganga	10-20	—	Crocodiles seen by fishermen where Amban Ganga enters. Area bordered by some good forest.
56.	12-10-77	Minneriya Tank	“	6300 acres	Mahaweli Ganga	10-20	—	Crocodiles rarely seen though habitat appears suitable. Sanctuary and Biosphere Reserve area; formerly had good crocodile population.
57.	12-10-77	Thenadhra Tank (Habarana)	“	small	—	few	—	Lotus filled, crocodiles seen seasonally in this and nearby small tanks.
58.	13-10-77	Kalunkerny Kulam (Mullaitivu)	Vavuniya	medium	—	10-20	8	This is a small tank but usually has enough water for the crocodiles. Young also seen by fishermen. Tank surrounded by grazing land and cultivation, very little forest.
59.	13-10-77	Nanthi Kadal Lagoon	“	20 km. long	—	nil	—	This shallow lagoon has no mangrove and dries up in summer. Crocodiles have been seen in transit during high water.
60.	14-10-77	Mamaduwa Tank	“	592 acres	Parangi Aru	20-40	2	This tank is surrounded mainly by forest and is excellent crocodile habitat.
61.	14-10-77	Iranaimadu Tank	Vavuniya	medium	—	10-20	3	Few seen by fishermen though habitat appears excellent with considerable forest surrounding. This and Kakkavi tank usually have water when other tanks dry out.
62.	15-10-77	Jaffna Lagoon	Jaffna	40 km long	—	nil	—	Though reported in old literature crocodiles seem to have become extinct in this area since several decades. Chundikkulam Sanctuary has occasional crocodiles, probably <i>C. palustris</i> from the tanks (Iranaimadu etc.).
63.	16-10-77	Mahakandarawa Tank	Anuradhapura	3600 acres	Aruvi Aru	20-40	17	Good habitat with nesting areas, forest. Young seen by fishermen Perennial; located in Mihintale Sanctuary.

64.	16-10-77	Rajangana Reservoir	"	3950 acres	Kala Oya	20-40	4	Large fishing industry here. Crocodiles occasionally caught in nets. Also seen in Kala Oya below dam. Mostly settled area.
65.	16-10-77	Tissa Wewa	"	460 acres	Aruvi Aru	nil	—	Before the recent drought several crocodiles were still seen.
	16-10-77	Basawak Kulam	"	265 acres		"	—	Traditionally a crocodile haunt.
	16-10-77	Nuwara Wewa	"	2956 acres		"	—	
66.	17-10-77	Pusiam Kulam	"	small	—	5	—	Up of 5 crocodiles seen every year except drought years in this pond on the Mahawilachiya Road.
67.	17-10-77	Mahawilachiya	"	2400 acres	Moderagam Aru	50-100	7	Fishermen report many crocodiles here but very shy because of heavy fishing and incidental crocodile catching. Good habitat on edge of Wilpattu National Park. Crocodiles also seen in Talava Oya below bund; heavy forest.
68.	26-10-77	Bogoda Lake (Virahera)	Colombe	large area	—	several reported	—	Nests of <i>C. porosus</i> reported in recent years in this dense marsh land. Babies caught in fish traps, crocodiles occasionally hunted at night or baited hooks set.
69.	27-10-77	Chilaw/Kurunegala Road	Kurunegala	large area	—	nil	—	Much swampy habitat with former crocodile population. Settlement and cultivation has replaced most optimum habitat.
70.	29-10-77	Parana Ela (Wattala)	Colombo	10m wide canals	Kelani Ganga	several reported	—	Seasonal movement of a few <i>C. porosus</i> . One 2½m. crocodile in residence, swampy areas in the midst of factory and residential developments. The Muthurajavela swampland between Negombo and Colombo is the main "recruitment" area for <i>C. porosus</i> here.

Several tunnels in sides of this stream. Fishermen report occasionally sighting crocodiles here. Young *C. porosus* and *C. palustris* have been caught in this area. Residents and fishermen state that few crocodiles are seen any more, but that in parts of the dense inland swamp nesting still occurs.

Crocodiles formerly plentiful according to fishermen and river sand workers. Areas where they still can be seen (*C. porosus*) at Kohotana (down river) 10 Kms. and Gonaduma on the Piliyandala Road.

Crocodiles (*C. porosus*) scarce but occasionally seen at Avithathana.

Small crocodiles seen in fish traps. Larger crocodiles occasionally seen in swamp several miles from Alutgama on the Elipitiya Road.

Fishermen report seeing young crocodiles and rarely an adult these days. A branch of this river, Batapola Ela, is also reported to have some crocodiles left. People along the Karadeniya River (a branch of the Madampa) are reportedly fond of catching and eating crocodiles.

Fishermen and residents report occasional crocodile sightings. One (3m.) reported killed recently which had caught many dogs (Kotiduwa). Though crocodiles formerly here, now absent since the establishment of the Plywood Corporation mill.

SUMMARY OF E. WEDANDA'S RESULTS

71.	22-10-77	Attanagalu Oya (Gampaha)	5m. wide	—	4	tracks	
72.	23-10-77	Negombo lagoon	15km. long	—	few	—	
1.	3-10-77	Kaluganga River	20-40m. wide	Kaluganga	several reported	—	
2.	3-10-77	Benthara River	—	10-20 m. wide	few	—	
3.	3-10-77	Dedduwa River	10m. wide	—	few	—	
4.	3-10-77	Madampa River (Ambalangada)	10m. wide	—	„	—	
5.	4-10-77	Hikkaduwa Lake	medium	—	„	—	
6.	4-10-77	Gin Ganga (Ginthota)	10-15m. wide	—	nil	—	



7.	5-10-77	Nilwala Ganga (Matara)	Matara	30-40m. wide	Nilwala Ganga	several	—	At Kapuwa Ela, a branch of the Nilwala Ganga up to 6 crocodiles have been seen recently and nests in the past. Here there is a well known crocodile hunter.
8.	5-10-77	Tangalla	Hambantota	—	—	few	—	Crocodiles rarely seen now but now and then in the river after heavy rains.
9.	6-10-77	Walawe Ganga (Ambalantota)	“	30-40m.	Walawe Ganga	“	—	Crocodiles very rare now, seen few miles up river on occasion. At Godawaya is a place called “Kimbulkatte” (crocodile’s mouth) which has mangrove and a few crocodiles are still reported here. Crocodile reportedly shot recently by police constable.
10.	6-10-77	Ridiyagama Tank	“	2195 acres	Walawe Ganga	50-100	—	Young crocodiles caught recently by fishermen. Tank said to still have a fair population.
11.	8-10-77	Thamara Kulam	Amparai	small	—	nil	—	Dry now, the small tank generally has a small crocodile population even though located on the edge of Pottuvilp town. Also at Rottai Kulam nearby.
12.	8-10-77	Semmani Kulam	“	medium	—	10-20	tracks, feces	This is one of the last tanks in the Pottuvilp area to dry up. Apparently crocodiles from small tanks come here.
13.	8-10-77	Panama Lagoon Arugam Bay Lagoon	“	“	—	few	1	Crocodiles move seasonally in and out of these lagoons. <i>C. porosus</i> appears to be quite rare; <i>C. palustris</i> apparently uses the lagoons to tide over the drought period.
14.	9-10-77	Landandara stream (Pottuvilp)	“	small	—	2	1	Though a very small stream, the pools support a small crocodile population which have tunnels under over hanging tree roots.

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15.	9-10-77	Sakamam Sanctuary	"	medium	—	few	1	These lagoon areas have little suitable habitat left. Observed one crocodile by night on small river near coast here.
16.	9-10-77	Ooraniya Oya (Kalmunai)	"	small	—	"	tracks	A few crocodiles remain in the pools and streams of this area.
17.	11-10-77	Kantalai Reservoir	Trinco-malee	5850 acres	Mahaweli	10-20	—	Fishermen report that crocodile population much lower than formerly. Few crocodiles seen recently. Nesting observed in the north and west parts of the tank. In Kuda Wewa, adjoining Kantalai, a few crocodiles reported; also nearby Mora Wewa and Vadasen tank.
18.	11-10-77	Paravipanjam Kulam	"	medium	"	over 50	tracks	Crocodile reported recently killed here. Good habitat in these areas, forest etc. Well organized hunters visit annually it is reported here.
19.	12-10-77	Periya Kulam	"	275 acres	Panna Oya	10 "	—	Several crocodiles caught here in past few years, a few can be seen regularly basking. Jungle area, good possible crocodile reserve.
20.	13-10-77	Irrakkakandi Lagoon	"	10 kms. long	—	several	—	Crocodiles seen fairly regularly by fishermen. Plenty of mangrove and other suitable habitat. Probably a <i>C. porosus</i> population.
21.	13-10-77	Trinco Lagoon	"	large	—	few	—	A large crocodile was reported seen recently in local newspapers. The formerly reported abundance of crocodiles is much changed now.
22.	13-10-77	Samara Kulam	"	medium	—	50-100	—	This is a wild area with good, intact forest. Fishermen report very little hunting of crocodiles here so there is still good population.

23.	13-10-77	Salpai Aru	"	small	—	50-100	—	Fishermen see crocodiles fairly regularly near mangroves, particularly at night. Crocodiles caught here for drying the flesh by fishermen. More are seen in the interior during the rainy months.
24.	13-10-77	Periya Villu (Kuchchaveli)	"	medium	—	few	—	Up to 10 large crocodiles seen here regularly, young also seen. Stream Vaval Oday has a few crocodiles.
25.	13-10-77	Niela Panikkam Kulam (Tiriyai)	"	"	Yan Oya	many	—	This lagoon is one which has water for most of the year. Crocodiles are seen regularly and fishermen feel that they have tunnels in the extensive mangroves. During the drought periods many crocodiles killed here and turned into "dry fish."
26.	13-10-77	Yan Oya	"	small	"	several	—	Fishermen report that several miles upriver in the interior many crocodiles can still be seen, tunnels in river bank etc.
27.	14-10-77	Padawiya Tank	Anuradha-pura	6480 acres	Ma Oya	50-100	—	According to Irrigation Department staff and fishermen crocodile population is stable or increasing here. Little or no killing of crocodiles. The Wan Ela canal from the tank has deep areas in which crocodiles live, burrow into banks etc. Young crocodiles seen recently.

Summary of Results etc.

Introduction :

In the brief period spent on this survey a representative coverage was made of crocodile habitat in Sri Lanka. A cumulative 5,000 kms. was covered by the survey team and total of 300 crocodiles observed. In the wild and semi wild habitat of this small island live more wild crocodiles than on the entire Indian mainland.

The populations of *C. palustris* within the two largest National Parks will apparently withstand Sri Lanka's rapid development (settlement, plantation, deforestation, dams etc.) but unless the ecological and economic value of these reptiles is recognized they will soon be exterminated in the rest of the country. Inland fisheries in general and the important fishermen in particular stand to benefit greatly if the crocodile resource is allowed to remain through wise management. Cropping, quotas, size limits to protect the breeders and publicity to gain sympathy and tolerance for crocodiles will help ensure their perpetuation.

The saltwater crocodile has much less chance of survival and as already mentioned its fate is dependent on the identification of a suitable area as a preserve. As it has the most valuable skin of any crocodilian in the world, important consideration should be given to both captive and wild propagation for economic return to hunting and fishing people of the lower income brackets.

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